

[0082] What is claimed is:

1. An apparatus comprising:

an acoustic source configured to be acoustically coupled to a variable-volume chamber;

a microphone configured to be acoustically coupled to the variable-volume chamber; and

a processor configured to receive a signal from the microphone, and further configured to determine a volume of the variable-volume chamber based on the received signal, the processor being embedded on a printed circuit board.

2. The apparatus of claim 1, wherein the acoustic source is embedded on the printed circuit board.

3. The apparatus of claim 1, wherein the microphone is embedded on the printed circuit board.

4. The apparatus of claim 1, wherein the printed circuit board is disposed within a housing, and wherein the printed circuit board defines a first volume and a second volume within the housing.

5. The apparatus of claim 4, wherein the processor is further configured to send a control signal to a valve, the control signal associated with the volume of the variable volume.

6. The apparatus of claim 5, wherein the control signal includes information associated with releasing an amount of fluid.

7. The apparatus of claim 5, wherein the control signal is further associated with a volume of fluid in aerosolized form.

8. An apparatus comprising:

a housing containing a first volume and a second volume, the housing configured to be acoustically coupled to a third volume;

a first microphone disposed within the first volume;

a second microphone disposed within the second volume;

a printed circuit board disposed within the housing such that the printed circuit board separates the first volume from the second volume, the printed circuit board including an acoustic source;

and wherein the apparatus further comprises a processor configured to calculate a change in the third volume that is associated with an amount of fluid output.

9. The apparatus of claim 8, wherein the printed circuit board further includes the processor.
10. The apparatus of claim 8, wherein the third volume is contained in a removable cassette, and wherein the second volume is acoustically coupled to the third volume by a port.
11. The apparatus of claim 8, wherein the printed circuit board includes an inner layer configured to pass electrical signals.
12. The apparatus of claim 8, wherein the processor is further configured to
 - receive a signal from the first microphone;
 - receive a signal from the second microphone; and
 - output a control signal to a valve, the control signal being associated with the received signal from the first microphone and the received signal from the second microphone.
13. The apparatus of claim 8, wherein the printed circuit board includes a means for pressure equalization between the first volume and the second volume.
14. The apparatus of claim 8, wherein the printed circuit board includes a means for pressure equalization between the first volume and the second volume.

15. The apparatus of claim 8, wherein the acoustic source is a piezoelectric speaker.

16. An apparatus comprising:

a housing configured to be in communication with a valve, the housing containing a first volume, a second volume and a third volume that is acoustically coupled to the second volume;

a printed circuit board disposed within the housing such that the printed circuit board separates the first volume from the second volume, the printed circuit board including

an acoustic source;

a first microphone disposed within the first volume;

a second microphone disposed within the second volume;

and wherein the apparatus further comprises a processor configured to calculate a change in the third volume that is associated with an amount of fluid output.

17. The apparatus of claim 16, wherein the printed circuit board further includes the processor.

18. The apparatus of claim 16, wherein the second volume is acoustically coupled to the third volume by a port.
19. The apparatus of claim 16, wherein the printed circuit board includes an inner layer configured to pass electrical signals.
20. The apparatus of claim 16, wherein the processor is further configured to

receive a signal from the first microphone;

receive a signal from the second microphone; and

output a control signal to the valve, the control signal being associated with the received signal from the first microphone and the received signal from the second microphone.
21. The apparatus of claim 16, wherein the printed circuit board includes a means for pressure equalization between the first volume and the second volume.
22. The apparatus of claim 16, wherein the acoustic source is a piezoelectric speaker.
23. The apparatus of claim 16, wherein the third volume is an air region that is separated from a fluid region by a diaphragm, and wherein the air region and the fluid region form a fixed volume.

24. An apparatus comprising:

a housing configured to be in communication with a valve;

a printed circuit board disposed within the housing such that the printed circuit board defines a first volume and a second volume, the printed circuit board including

an acoustic source;

a first microphone disposed within the first volume;

a second microphone disposed within the second volume;

and wherein the apparatus further comprises a processor configured to calculate a change in the second volume that is associated with an amount of fluid output.

25. The apparatus of claim 24, wherein the printed circuit board further includes the processor.

26. The apparatus of claim 24, wherein the printed circuit board includes an inner layer configured to pass electrical signals.

27. The apparatus of claim 24, wherein the processor is further configured to

receive a signal from the first microphone;

receive a signal from the second microphone; and

output a control signal to the valve, the control signal being associated with the received signal from the first microphone and the received signal from the second microphone.

28. The apparatus of claim 24, wherein the printed circuit board includes a means for pressure equalization between the first volume and the second volume.

29. The apparatus of claim 24, wherein the acoustic source is a piezoelectric speaker.

30. The apparatus of claim 26, wherein the second volume is an air region that is separated from a fluid region by a diaphragm, and wherein the air region and the fluid region form a fixed volume.